MONTANA Wildlife

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Bighorns and Lungworm

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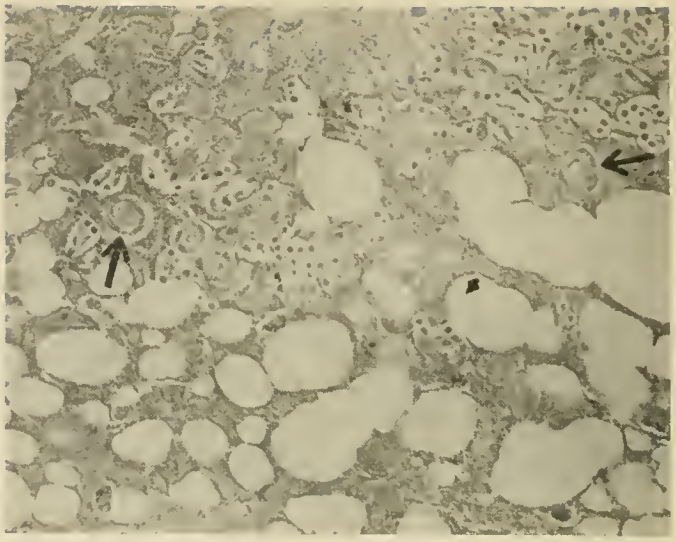


Coiled lungworm larvae in lung tissue of an infected sheep—(magnified 75X). Photo by C. M. Senger

Bighorn sheep are one of the symbols of wilderness in western United States and Canada. A glimpse of a big ram in natural surroundings has thrilled many a wilderness traveler time and again. Through a recent interest in preserving this animal for its own sake as well as for trophy hunting, many people wonder: "What is the status of the bighorn today?"

Prior to 1800 there were an estimated two million bighorn sheep in North America. Settlement of the west by white man was followed by a decrease in bighorns and elimination of many herds. Today only about 18,000 bighorns remain in the United States. Over-hunting, competition for range and disease apparently were responsible for the initial decline during the 19th century. That decline has continued in the 20th century and several of the more recent die-offs of bighorns have been studied in detail. These are listed in the following table.

Date	Estimated Loss of Herd	Location
Winter, 1905-06	"Mass Mortality"	Salmon River, Idaho
Winter, 1923-24	338 of 350 Died	Tarryall Mountains, Colorado
Winter, 1924-25	186 of 250 Died	Sun River, Montana
Winter, 1926-27	26 of 150 Died	Glacier National Park, Montana
1927-1929	Decreased from 346 to 77	Yellowstone National Park, Wyoming
1930	66 of 100 Died	National Bison Range, Montana
1934-1936	600 of 1200 Died	Jackson Hole, Wyoming
Winter, 1936-37	33 of 84 Died	Glacier National Park, Montana
1920-1939	Decreased from 1000 to 329	Rocky Mountain National Park, Colorado
1940	35 of 65 Died	National Bison Range, Montana
Winter, 1952-53	Decreased from 1500 to 500	Pike's Peak, Tarryall, and Kenosha Ranges, Colorado
Winter, 1955-56	21 of 150 Died	Salmon River, Idaho
Winter, 1955-56	10 of 50 Died	Glacier National Park, Montana
1939-1959	Decreased from 329 to 210	Rocky Mountain National Park, Colorado

Such factors as mineral and protein deficiencies, range competition and depletion, predation and persistent hunting have been implicated along with disease in these more recent declines. Mange (scabies), scours (coccidiosis) and lumpy jaw (necrotic stomatitis) have been reported as important diseases of bighorn sheep, but lung disorders appear to be the most important. Many of the earlier die-offs of bighorns in Montana, Colorado, Wyoming, Idaho and Canada were thought to have been caused by a lung disease similar to shipping fever or hemorrhagic septicemia of domestic animals. It wasn't until 1927 that Dr. Hadleigh Marsh of the Montana Livestock Sanitary Board noticed roundworms in the lung tissue of sheep dying of pneumonia in the Glacier National Park herd. This lungworm was later named **Protostrongylus stilesi** after Dr. George Stiles who found them in the lungs of sheep from the Pikes Peak herd of Colorado during 1930. Biologists then felt that the early losses, which had been attributed to hemorrhagic septicemia, actually may have been caused by this lungworm and an associated type of pneumonia. This would mean that pneumonia was responsible for the death of the bighorns, but this pneumonia was related to the tissue damage caused by large numbers of lungworms.

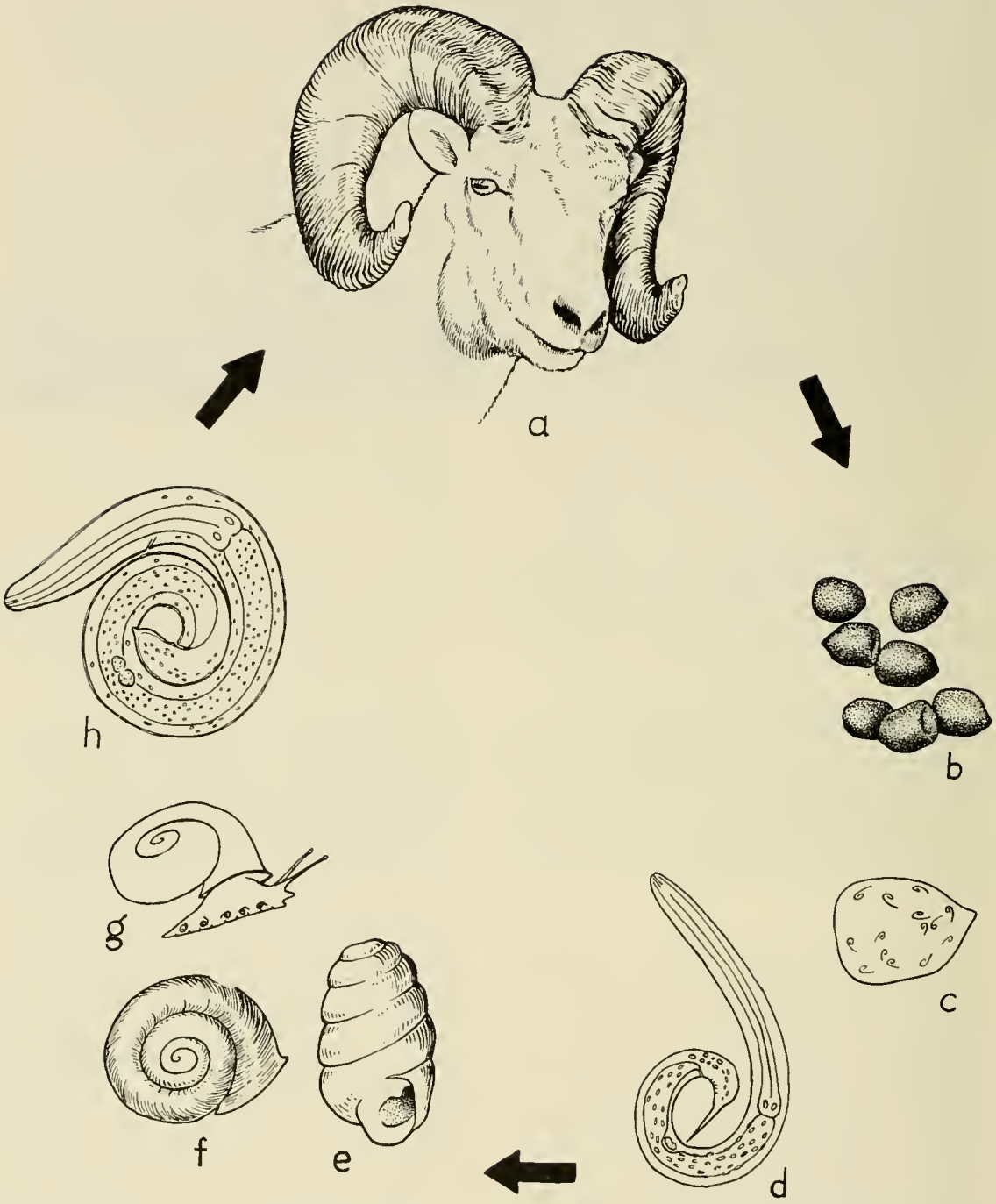
Lungworms similar to those found in bighorns are known to occur in the lungs of Dall sheep. mountain goats, whitetailed deer, mule deer, elk, cottontail rabbits and snowshoe hares. In these animals, lungworms apparently do not result in pneumonia and subsequent population control as do the lungworms of bighorn sheep. Lungworms also occur in domestic sheep and goats but are a different species than the bighorn lungworms and have not been the source of infection of wild sheep.

The life cycle of the bighorn sheep lungworm has not been proved conclusively, but it is believed to be as follows: the male and female adult lungworms mate in the lungs of a bighorn and the

Droppings from this 3-month old bighorn did not contain lungworm larvae, although animals as young as six weeks have been found to be infected. The age at wihch infection shows up seems to vary considerably. Photo by P. S. MacLachlan

females deposit eggs which hatch into first stage larvae. These larvae or immature lungworms migrate up the respiratory passages, are then swallowed and pass out through the intestinal tract in the fecal droppings. The larvae leave the droppings during proper conditions of moisture and temperature and when they come in contact with a certain type of land snail, they enter its foot. Inside the snail the larvae molt twice and become infective larvae. For the life cycle to be completed, snails containing infective larvae must be eaten by a bighorn. This probably occurs accidently while sheep eat forage infested with the tiny snails. These snails average ⅛ inch in diameter. Large snails, which commonly occur in many bighorn areas, have not been found to serve as intermediate hosts. Once the infective larvae are in the sheep they penetrate the intestinal lining and enter the blood stream which carries them to the lungs. There they develop into the adult stage and start the cycle once again.

Since 1927 lungworm has been reported in the bighorns of Montana by many biologists and its presence is now well established. From 1942 to 1944 Faye M. Couey of the Montana Fish and Game



The probable life cycle of bighorn sheep lungworms; (a) bighorn sheep with adult lungworms in lungs, (b) fecal droppings from bighorn, (c) first stage larvae in droppings (diagramatic view), (d) first stage larva (greatly enlarged), (e) and (f) intermediate host land snails, (g) land snail with infective stage larvae in foot (diagramatic view), (h) infective stage larva (greatly enlarged). Drawing by E. H. Froeschner

Department surveyed bighorn sheep and found that the Ural Tweed, Thompson Falls, Gallatin, Yellowstone, Stillwater, Rosebud and Sun River herds were all infected. He worked mainly with the Sun River sheep and found by fecal analysis that 85% of the population was infected with lungworms.

In 1958 a study of the biology of bighorn sheep lungworms was initiated by the Department of Zoology and the Montana Cooperative Wildlife Research Unit of Montana State University. Recently the National Science Foundation has provided financial support (NSF Grant No. 19422) to the authors to continue this research. The major objectives of this investigation have been to determine the extent of lungworm infection in bighorn sheep of Montana and to learn more about the life cycle and ecology of this parasite.

Through the cooperation of the Montana Fish and Game Department, bighorn sheep hunters were asked to turn in lungs from their bighorns during 1958, 1959, 1961 and 1962. Response of hunters was excellent and well over 100 lungs were obtained in this manner. All the lungs were found to contain lungworms.

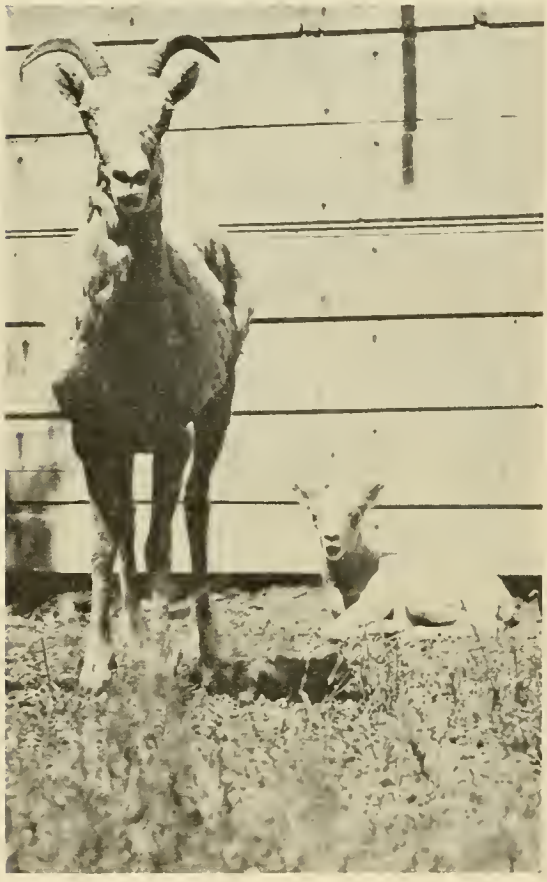
An infected lung has lumps or lesions on the surface which vary from the size of a pinhead to as large as a silver dollar. These lesions contain the hair-like adult lungworms and hundreds of thousands of eggs and larvae. There were variations in the size of the infection from bighorn to bighorn and from herd to herd. Those lungs from the Gallatin, Stillwater and the Sun River areas contained the most severe infections with as much as one-tenth of the surface area of the lung covered with lungworm lesions in some cases. Infections in the Kootenai Falls, Ural Tweed and Rock Creek herds were less severe. Fresh droppings have been collected from 11 bighorn herds in Montana. Lungworm larvae were found in samples from the Stillwater, Gallatin, Rosebud, Yellowstone, Rock Creek, Sun River, Bison Range, Wildhorse Island, Ural Tweed, Kootenai Falls and Many Glacier herds.

There seems to be a variation in the number of larvae in bighorn feces depending on the season. In the spring the numbers of larvae in droppings are higher than at other times of the year. This is interesting because it is at this time of year that weather conditions are most favorable for snail activity. Thus, there

This map of western Montana shows general locations of the ten major bighorn sheep herds.

Individual bighorn lambs on Wildhorse Island were marked with colored plastic ear tags and lungworm infections were checked periodically by dropping analysis. Photo by D. J. Forrester

This bighorn ewe was trapped at Sun River and transferred to a pen in Missoula where she gave birth to a lamb. The ewe had a high lungworm infection. When the lamb was ten days old its lungs were examined and found to contain immature lungworm larvae. Photo by D. J. Forrester



is probably a greater chance that snails will contact lungworm larvae and bighorns will eat infected snails and establish an infection during this season.

On Wildhorse Island, lambs six weeks old have been found infected with lungworms. There is even some evidence of infection occurring before birth. If this is true it would help explain why lungworm is so widespread in the bighorns of Montana and other areas.

Land snails, which have been identified by Richard E. Pillmore as intermediate hosts of the lungworms in Colorado's bighorns, occur on all the major bighorn areas in Montana. It is quite probable that these snails are transmitting the infective larvae to the sheep. On areas where small lungworm infections occur, such as on Wildhorse Island and the Bison Range, these snails, belonging to the families Pupillidae and Valloniidae, are scarce. However, they are more common in the Gallatin, Stillwater and Sun River areas where high lungworm infections are found.

Lungworm larvae deposited on the bighorn range in feces are capable of surviving extremes in weather. Laboratory and field experiments have shown that many larvae in dry fecal pellets can live through very hot and cold conditions. Surprisingly, some larvae were alive in dry pellets after exposure to a temperature of 160° F. for four days. Faye Couey found living

As a rule, older bighorns have more severe lungworm infections, but this does not affect edibility of the meat. Photo by D. J. Forrester.

larvae in droppings that were stored for 20 months in an out-building during which time temperatures were as low as —40° F. This indicates that the range is not cleaned each year and lungworm larvae may survive from season to season in old droppings or in snails; thus, infections may build up in certain areas.

Presently, the extent of lungworm infection in Montana and other North America bighorn sheep is fairly well known. Much information has been gathered on the life cycle of this parasite, although it is not yet satisfactorily understood. But how important is lungworm in controlling bighorn sheep numbers? Considerable evidence suggests that bighorn numbers are seriously controlled by disease. Undoubtedly the lungworm-pneumonia complex is one of the most important of these diseases. The situation may be further complicated by viruses.

Before the population dynamics of bighorn sheep can be properly understood, the relationship of lungworm to bighorn density and range conditions must be studied and evaluated. Lungworm-infected bighorns seem to thrive better when their numbers are kept somewhat below that which the range can sustain. Continued research on this subject should provide a basis for sound management of bighorn sheep and it should become possible to insure that the violent population fluctuations of the past will become mild fluctuations in the future.

Through an understanding of the factors limiting bighorn populations man should be able to harvest the excess for his own use and enjoyment rather than let the animals die by natural causes. Photo by D. J. Forrester.

In nearly every marsh area of any size, the muskrat houses of mud and vegetation are a familiar part of the landscape.

Montana's Muskrats

By ROGER FLIGER — Photos By Author

The muskrat is often referred to as the "million dollar rat" by people in the fur business. While its actual pelt value doesn't rival that of the mink or otter, great numbers and wide distribution make up for its shortcomings in quality.

The rich brown fur with its long glossy guard hair has remained a favorite on the fur market despite the comparatively low price per pelt. They are easily trapped and require little preparation and care before market, although much profit is lost when pelts are not properly cared for.

The range of the muskrat spans the continent of North America ending only in the barren Arctic and desert regions. As irrigation moves into arid regions so does the muskrat. A fairly steady supply of water, a few cattails and, like the boll-weevil, he's found a home.

Like other rodents, muskrats are capable of explosive population increases. Mating begins in late March and the first litters are born in mid-April. Where conditions are ideal two, three or even four litters of young may be born during warm months. A litter may contain three to ten young while six is the average. The young are born blind and helpless but within a month they are eating vegetation and are on their own shortly thereafter.

Streams, marshes, lakes, ponds, irrigation ditches all have their resident muskrats. They may either burrow a tunnel into a stream or ditch bank or build a structure house with available vegetation and mud. These rat houses are usually along shallow margins of a pond or marsh. The houses may be as much as five feet (above water) and eight feet in diameter and have an inside resting platform and several underwater escape channels. The rat house may also serve as late winter

forage after ice has curtailed the food and movements of the muskrat. A large house will be used by three to eight individuals.

Muskrats may have small feed beds or platforms which resemble miniature rat houses a few feet to fifty yards from the main house.

The muskrats feed almost entirely on vegetable material including cattails, bullrushes, arrowhead, sedges and young trees such as willow. Flesh is also consumed at times. Fresh water mussels, dead waterfowl, fish and, during times of famine, flesh of its own kind is eaten.

The muskrat has many enemies. Disease and parasites are dangerous where populations are dense. Natural enemies such as mink, fox, coyote, hawks and owls take a heavy toll. Snapping turtles, snakes and large fish are some of the more unusual enemies. A six-pound brown trout was found to have a half-grown muskrat in its stomach.

Floods sometimes drown out young muskrats and late summer drying-up of marginal ponds force residents out. Muskrats killed on highways and found in chicken coops and home basements are usually forced out wanderers.

Muskrats can be both managed and used as management tools. The ideal conditions to stimulate muskrats coincide, to some extent, with waterfowl marshes. Shallow water one to three feet in depth and an ample supply of emergent vegetation such as cattails and sedges is ideal habitat for the water rodent. Muskrats often open up holes in heavy vegetation and provide feeding and resting places for ducks.

Trapping is a popular sport and few animals are more easily trapped. Traps set at feed beds, runways or other places where tracks or signs of muskrats (cut

vegetation) will usually produce catches. No. 1 and 1½ long spring traps are used but should be wired or staked into deep water to insure drowning. Drowning the animal is essential because a muskrat can readily twist off its front foot. Traps should be set from ½ to 3½ inches under water. The latter will produce a hind foot grip which is far more secure than a front foot grip. There are several traps on the market that either kill or have wire spring devices that keep the muskrat from twisting off.

Traps should be visited frequently especially during warm periods when muskrats are feeding or moving. A good resolution would be to pass up a set if it wouldn't drown the victim. A drowned animal will not get away or be destroyed by other animals.

Approximately 30,000 muskrats were taken during 1961 in Montana. The average price was 50-55 cents per animal.

Muskrats will remain high on the list of the farm or ranch lad with a half-dozen traps or the professional trapper with hundreds of traps.

The anticipation that makes trapping a sport is most often satisfied while trapping the muskrat. He's still the "million dollar rat."

When shocking with direct current, fish are drawn to the positive electrode where they are picked up with nets.

Fishing With Electricity

By GEORGE D. HOLTON, Chief Fisheries Biologist

Techniques of electrofishing have been developed by workers in many places including Montana. This discussion is an effort to give those unfamiliar with the method an idea of how it works. Many sources of information have been drawn upon; particularly: THE ELEMENTARY PRACTICE OF ELECTRICAL FISHING IN FRESH WATER published by the Ministry of Agriculture, Fisheries and Food, Whitehall Pl., London, England.

Fishing with electricity has stirred the imagination of many fishermen. Some have seen a fish shocking crew in action; others have read of fish being drawn by electricity as if by a magnet from undercut banks, brush piles, and other hiding places. Some expect too much from electrofishing — they wonder why it is not used to remove carp and suckers from lakes.

Electrofishing is not a miracle method—it has limitations. For example, it is difficult to collect fish from water deeper than five feet, from waters that are not good conductors of electricity, or from waters that conduct electricity too well. Nevertheless, shocking is the best way known for taking fish unharmed from shallow waters that are brushy or snag-filled.

Why should one want to collect fish in the first place? Fish must be collected if their populations are to be assessed. That is, if the numbers, kinds, ages, growth rate, and general well being of fish in a particular water is to be determined. Then too, fish must be captured if they are to be tagged or otherwise marked for migration or survival studies.

Apparently the earliest use of electricity for studying fish in streams was in eastern Germany. Fisheries workers in the New York State Conservation Department

were the first in the United States to employ it. This was in 1939. Next it was used in Michigan and then its use became widespread throughout the United States and Canada. It is not legal to use electricity for fishing unless authorized by special permit.

Basically an electric fish shocker consists of a generator connected by a long two-wire extension cord to two electrodes or conductors. The electrodes introduce the electricity into the water, and, in effect, one is connected to each pole of the generator. An electrode may, depending upon conditions, be a metal plate, a wire grid or simply a chain, wire or wire loop. If it is to be carried in a stream it is attached to a wooden or insulated handle 4 to 6 feet long.

THE ELECTRIC FIELD IN WATER

When an electric current passes through water from one electrode to another it spreads out and can be detected in all parts of the water. The effects of voltage and current are thus spread throughout the whole water area. The closer an object such as a fish is to an electrode the more it is affected.

The amount of current flowing through an object in the field will depend on the difference in voltage at each end of the object. This in turn depends on the length of the object. The effective voltage may therefore be conveniently reduced to volts per inch—that is, the difference of voltage at opposite ends of a one-inch length. This may be called the **voltage gradient.** It is a convenient measure of the local intensity of a current and thus the strength of the electrical field at any given point.

As the current spreads out into all parts of the water from an electrode it becomes progressively weaker as the distance increases. The voltage gradient follows the same pattern, and shocking is effective on fish only a relatively short distance from the electrodes.

Unless the electrodes are very close together, the distance they are apart does not affect the amount of current flowing between them. The whole resistance of the water to the electricity may be considered as concentrated into a sphere surrounding each electrode. Outside these spheres the current can flow without obstruction, and consequently without loss of voltage. A separate field surrounds each electrode like an invisible sphere and fish which enter it immediately come under its influence.

Electrofishing from a boat with pulsed direct current.

ACTION OF ELECTRICITY ON FISH

If a difference of voltage exists between the head and tail of a fish, a current will flow through it. If this current is strong

enough the fish will be incapacitated. The size of a fish and its proximity to an electrode determine how much current will go through it and how many volts it will receive. Large fish receive a relatively greater voltage in the water than small ones, and therefore are stunned by a smaller voltage output.

The current may flow steadily from one electrode to the other, in which case we have direct current (D.C.); or it may flow from first one and then the other many times a second, in which case we have alternating current (A.C.).

In an alternating current field of sufficient power the fish become paralyzed and rapidly lose consciousness. When the current is switched off, the fish revive after a short time, depending on the duration and severity of the shock received, and show no after effects. A voltage gradient of 0.5 volts per inch in the water is normally adequate to stun most fish.

In a direct current field, however, fish turn to face the positive electrode, and swim towards it. Generally speaking there is no loss of consciousness, but should the field get strong enough, fish will turn over. In this condition their bodies are entirely relaxed, and they recover instantly when the current is switched off. A gradient of 1.0 volts per inch in the water produces this effect.

DANGERS INVOLVED

It is possible to injure or kill fish with electricity. A fish left in an alternating current field will die of suffocation because his breathing apparatus becomes paralyzed. Excessive alternating current may result in damage to the backbone or ruptured blood vessels—particularly if excessive current is suddenly applied. The damage is caused by severe muscle contractions. There is less danger of injury with direct current since it narcotizes fish and leaves them limp. If proper precautions are taken with either alternating current or direct current, the proportion of casualties is small.

None of the various types of electrical currents influence the growth rate of fish. The viability of eggs being carried by female fish is not affected, and only in unusual circumtances could eggs in redds or nests be affected. Due to the small size of aquatic insects and other fish food animals there is no chance of electrofishing depleting their numbers.

There is danger to the electrofishing crew since the voltage and current capacities of the power units are lethal. Then too, stream beds are often paved with slippery boulders making wading difficult and the danger of someone falling into the water is ever present. Fisheries workers across the country have been involved in several serious electrofishing accidents including one fatality.

Non-slip, non-leaking boots or waders should be standard equipment when electrofishing. Rubber gloves should be added when higher voltages and currents are involved. The generator and other apparatus should be maintained in good condition—that is, all shock hazards promptly remedied. Above all, each man should understand his job thoroughly, including safety precautions and emergency procedures.

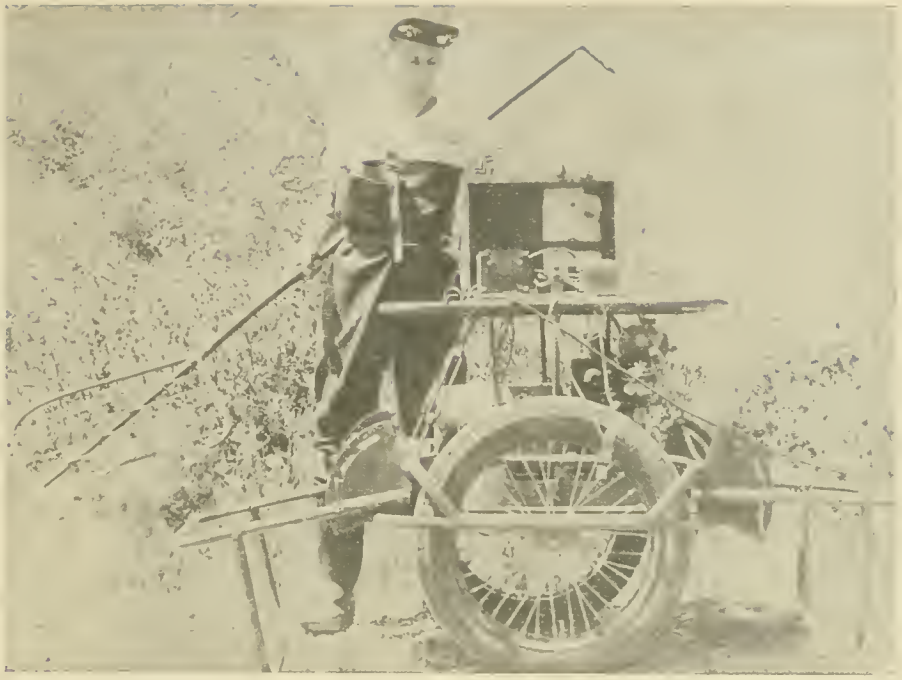
FISHING METHODS

There are many varieties of fish shockers, but for the most part, all are adaptations of the same basic principles. This discussion will be limited to equipment used in Montana.

A.C. shockers were the first to be described in the fisheries literature and likewise were the first to be used in Montana. They are particularly adapted to streams up to five feet deep with a fairly smooth bottom. Fish can be driven from deeper holes but are difficult to net since they tend to settle to the bottom when stunned. Then too, they are difficult to net when stunned in inaccessible places such as under banks and among tree roots.

Usually only two electrodes are used. They are carried on either side of the stream. The idea is to keep them close enough together so there is an electrical barrier through which fish cannot pass.

At the start of operations, the section



The first shocker used by the Fish and Game Department was an alternating current type assembled in the Fish and Game shops in 1949.

of stream to be shocked is blocked off with nets which serve as a fish-tight fence. The electrodes are either worked upstream between the blocking nets, or downstream, depending upon the water swiftness and type of bottom. If the bottom is silty and easily roiled, it is preferable to shock upstream. If the bottom is gravel or rock and the water swift, it may be preferable to work downstream since it is easier wading and the fish may be more easily recovered.

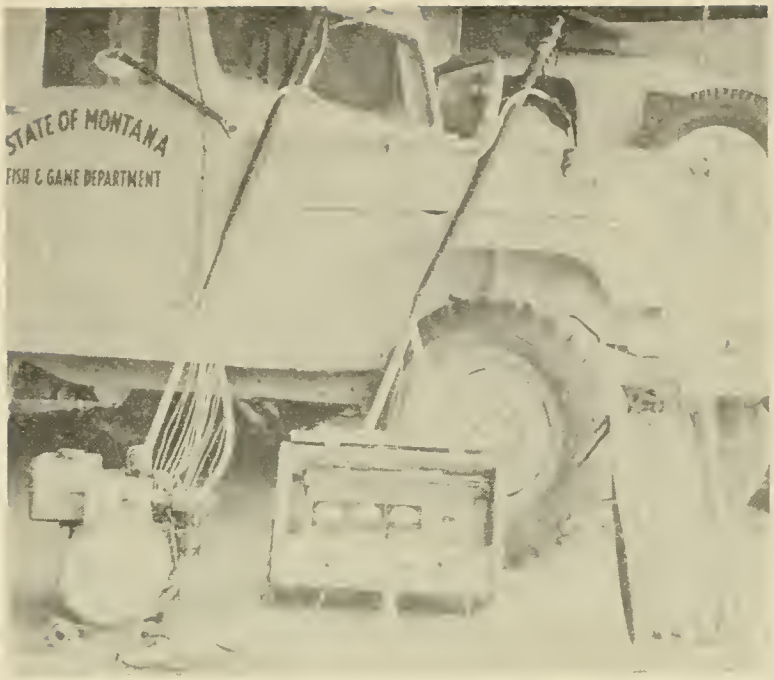
Some of the stunned fish float on the water surface. Commonly they make a dash to the top in an effort to escape the electrical field, become unconscious and sink. As fast as fish are stunned they are captured with dip nets and placed in holding pens. These are made of fine netting or wire and are partly submerged in the stream. Fish are generally rigid when stunned but soon recover in the holding pens.

D.C. shockers have both advantages and disadvantages when compared to A.C. shockers. Each end of the stream section to be worked is blocked with a fish-tight "fence" the same as when using alternating current.

In contrast to shocking with alternating current, where the two electrodes have the same effect, with direct current the positive and negative electrodes have different effects. Fish swim toward the positive electrode and therefore the men with dip nets can direct all their attention to it. A common type positive electrode used in Montana is shown in the photo of direct current shocking. The negative electrode may be thought of as an earth return. There is no advantage to having it near the positive. Therefore it may be placed on the bottom of the stream in the deepest water available near the generator.

Since fish swim toward the positive electrode they can be drawn from undercut banks, brush piles and other hiding places. With alternating current they often seek refuge in these places and cannot be recovered even when stunned. With direct current fish can be collected from turbid water where many of the fish stunned with alternating current would be difficult to see and net. Then too, with direct current fish can often be drawn from fairly deep water to an area where they can be more easily netted.

However, in terms of voltage gradient necessary to affect fish, direct current is



Montana's latest electrical fishing equipment produces a pulsed direct current.

much less efficient than alternating current. It requires about twice as many volts per inch to be effective. Consequently the useful field of an A.C. electrode extends about three times as far as that of a D.C. electrode at the same voltage, though the current is the same in both. Also extremes in water conductivity reduce the effectiveness of direct current more than that of alternating current.

Considerable power may be saved if direct current is used in short separate pulses instead of continuously. The effects of interrupted current is like that of a very powerful continuous direct current. Fish are collected at the positive electrode. They are more rapidly stunned and paralyzed than with non-pulsed direct current, and this sometimes means they are more difficult to net. However, the use of pulses is equivalent to a several-fold increase in power and has the advantage of reducing the effects that differences in water conductivity have on electrofishing.

ELECTROFISHING IN LARGE WATERS

As pointed out, when electricity is passed through water it spreads out into all parts of the body of water. It follows that it is more concentrated in a narrow, shallow stream than in a large river or lake. Using the same power plant, voltage gradients effective for electrofishing can be maintained over a greater portion of a small body of water than of a large one. As a result, electrofishing is best adapted to streams shallow enough to wade in chest-high waders.

However, fish can be collected with electricity from large rivers and the shallow areas of lakes. Here interrupted direct current is particularly useful.

The usual method is to float the crew, generator, pulse producing apparatus and other gear in a boat. A negative electrode is attached to the bottom of the boat, or if the boat is aluminum it may serve as the negative. The positive electrode is on the end of a ten-foot handle or boom attached to the bow of the boat. In streams the boat is guided downstream with the current.

Electrofishing in lakes has been found to be much more efficient when done at night. For this purpose underwater lights are attached to the bottom of the boat.

EFFICIENCIES

The chief difficulty in studying fish is not in just getting a sample of fish, al-

though getting representatives of each kind that lives in a body of water may be difficult enough in itself. The real problem lies in defining the relationship between the sample and the over-all population. In other words, a section of stream has been electrofished and one hundred fish have been taken. What do these one hundred fish represent—ninety percent of the population? Ten percent? or what?

When shocking small streams the majority of the fish, especially those over three inches long, are taken. Only rarely is it practical to try to collect all the fish from a section of stream by electrofishing. The efficiency of capture (the percentage of fish present that are captured) varies greatly with the size of fish and with different water types. As mentioned, larger fish are more easily captured than smaller ones.

In careful studies, the efficiency of the shocker in taking fish from a particular water is determined. This is generally done by having a known number of marked fish in a blocked off section. The section is then electrofished and the efficiency of the method is the percentage of the marked fish that are recaptured.

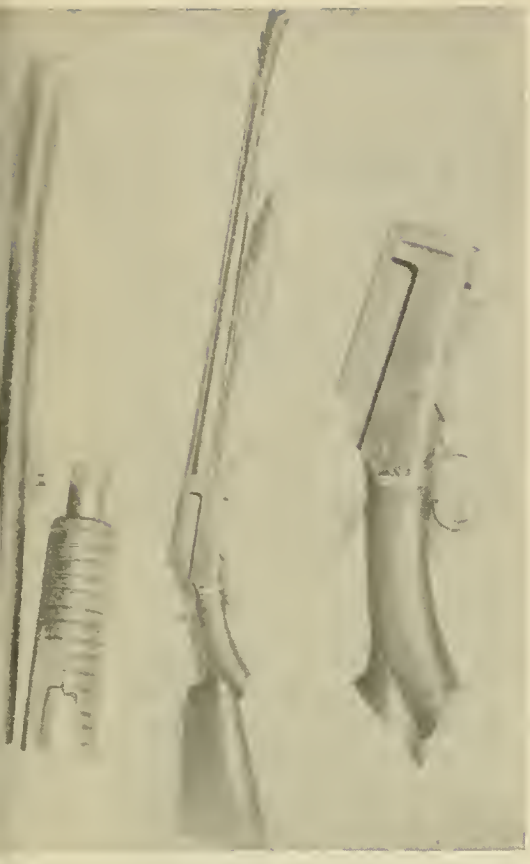
Still Time For Safety

Japanese World War II rifle. This rifle was crudely machined throughout with maximum use of stampings, so was a marginal firearm to begin with from the safety aspect. In addition, the person using this gun used hand loads which may have contained too much or the wrong type of powder.

Although the hunting season is past, the time for firearms safety is never past. Shooting, in its various forms, is for many a year-round sport. Many hunters like to keep in form for the hunting seasons by trap shooting and practice on indoor rifle ranges as well as shooting rabbits, gophers, etc.

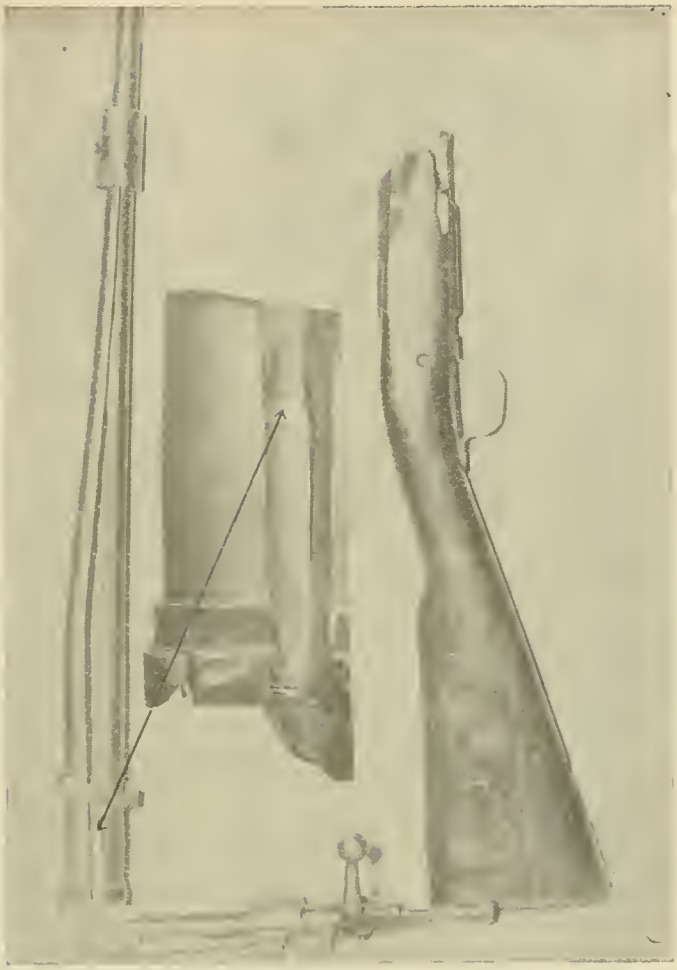
In addition to being careful in the field and on the range, both shooters and nonshooters alike should exercise great care to avoid firearms accidents in the home. Each year, almost as many people are victims of firearms accidents in the home as in the field. Loading and unloading firearms, cleaning ones which are not completely unloaded, and leaving loaded firearms where they are accessible to children are some of the more common causes of home firearms accidents. Remember, guns can kill anyone, any time, any place if improperly used.

Springfield Sporter. Shooter was firing at antelope, u parently contained no powder. When fired, the explos barrel where it lodged. The empty case was ejected first bullet was an obstruction in the barrel.



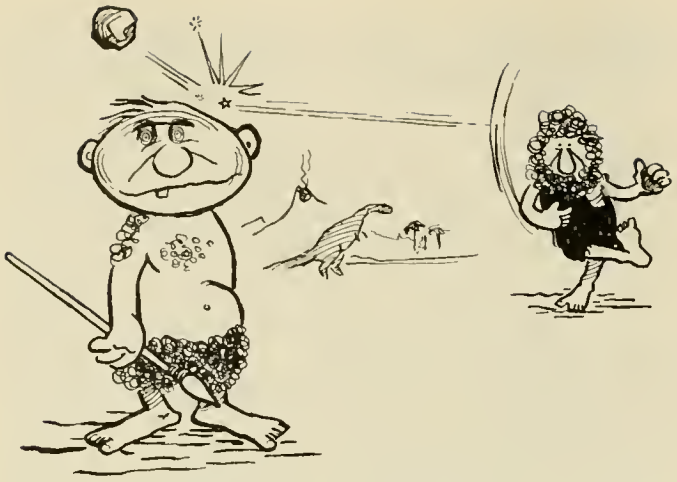
lin 12-gauge pump shotgun. Shooter inserted auge shell by mistake. This 20-gauge shell ained lodged in the barrel. He then inserted a auge shell and fired. Result—fatal gun acci-

g hand loads. One of the hand loads ap- of the primer forced the bullet into the d a new cartridge inserted and fired. The



1903 Model Springfield, World War I rifle. Shooter was using dubbed army ammunition (tip cut off to make it spread better). Possibly a portion of the jacket remained in the barrel causing an obstruction when the next cartridge was fired. It is also possible that this gun was very brittle or perhaps contained a concealed flaw.

Hopkins and Allen, double barreled 20-gauge shotgun. Shooter's father had put wax plugs in both ends of both barrels to seal against moistnre. Shooter removed the wax plng from the breech end when loading but forgot to remove the one from the muzzle.



Rocks to Rockets

NOTES ON THE HISTORY OF GUNS AND AMMUNITION

By
REX SMART
Montana Fish and Game Department
(Cartridges illustrated are from the author's collection)

From earliest history mankind has felt the need for some sorts of weapons. These have been used to reduce animals to food and clothing and as protection from enemies. Primitive men's first weapons were rocks and sharpened sticks for spears. By the time the long-bow and the cross bow came along, they were probably looked upon about like the H-bomb is today.

There was even discussion as to whether the cross bow was too horrible a weapon to be used in warfare and should be outlawed for that purpose. Men became very adept in their use and hunting became easier, but in warfare they were again on about an even basis and the search for better weapons moved ahead.

BLACK POWDER

Explosive powder was apparently first known in China but was mostly used for noise-makers and fireworks. It was not until the 13th century that it was discovered in Europe. For the next 500 years, black powder consisting of equal parts of saltpeter, sulphur and charcoal ground to the consistency of fine coal dust was the activating force in weaponry. This form of powder was usually called surpentine. The sulphur furnished the heat, the saltpeter furnished oxygen and the charcoal provided gas volume. In this combination, black powder burned very rapidly. The explosion actually followed the bullet only a short way down the barrel, giving poor ballistics. A great deal of energy was lost by gas escaping around the large round ball. Being very fine and soft, surpentine had a tendency to absorb moisture and explode poorly if it was tamped too hard. Coupled with the fact that this type of black powder left a lot of sooty residue in the bore, it was considered far from ideal and the search continued for better components.

At this time, manufacturers were finding that more pure ingredients produced a better product. Also, it was found that by varying grain size, it was possible to vary the burning rate. A ratio of 15 parts charcoal, 10 parts sulphur and 75 parts saltpeter (by weight) became the new standard. This formula, I think, would be close to present manufacture. Thus, black powder became a much more reliable propellant, but it still had defects. It gave off large quantities of smoke and flame that instantly revealed a man's position in battle. Its power was still relatively low and it left a heavy deposit to foul the barrel.

THE DEVELOPMENT OF SMOKELESS POWDER

In 1845, gun cotton was discovered in Switzerland. It was a powerful explosive and a great deal of time and effort was spent trying to adapt it as a propellant for small arms. This testing proved unsuccessful, however, for the new product was unstable. It was not until about 1885 that the French Government found that by dissolving gun cotton with ether, it could be dried, formed into flakes and safely used as a propellent. About the same time, in Italy, it was discovered that by treating glycerin with sulphuric and nitric acid a very high explosive was produced.

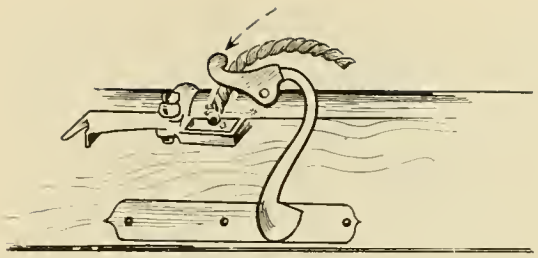
Nitroglycerin, as this mixture was called, was found to be far too potent for a propellant. Some time later in England, the problem was solved by mixing gun cotton and nitroglycerin into a gelatinous substance. When dried and formed into tiny cubes and cylinders this produced a suitable propellant. These two materials then became known as single and double base smokeless powder and with minor improvements are the same as used today.

This new substance, unlike black powder, burned only on the outside. As gas pressure developed, the bullet would start to move in the barrel and continued to pick up speed as gas volume increased. There was little or no smoke with this new powder. Cleaning after every few shots was also eliminated. Velocity was greatly increased. A new era of arms and ammunition had begun.

GUNS TO MATCH THE POWDER

Guns arrived with the discovery of black powder. First came the hand cannon which was little more than a pipe into which powder and ball were placed. A small hole in the top rear was known as the touch hole. The cannon was fired by passing a red-hot wire through this hole into the powder charge.

Soon the touch hole on the hand cannon was moved from the top to the side and a small pan added directly underneath. A small amount of powder was poured in this pan and ignited by using a pair of tongs to drop in a red-hot coal.

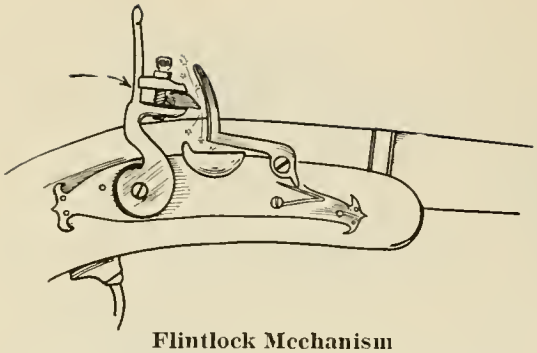


Matchlock Mechanism

After the addition of the pan, the next important development was the **match lock** in the early 1400's. This was accomplished by adding an S-shaped piece pivoted in the center and holding linen or hemp cord that burned very slowly. The shooter merely lowered this red-hot cord to the flash pan by moving the rod with his fingers. This was a very important development. Man no longer needed to be near a fire to shoot and also his right hand gave him more support for aiming. Thus the **match lock** gun taking on the shape of the guns to follow could probably be given the distinction of being the father of present day firearms. This gun was the standard arm in Europe with no major changes until about 1600 when it was given a trigger and a sear as we know it. Even though the old gun had its faults, such as having to adjust the burning cord and having it put out at times by rain, this arm was a favorite for many years.

The **wheel lock** was next in the parade and differed from the match lock by having a rough edged wheel fastened to the side of the lock and protruding through the pan. This wheel was wound against a main spring with a special key or spanner and when released turned against a piece of pyrite to throw sparks much as a cigarette lighter does today. This type was used for some time with success, but actually never did replace the match lock as a military arm.

The next ignition system was known as the **Flintlock.** There were several versions of this such as the Snaphaunce, Miguelet, English lock or Dog lock and others. These, I believe, were stepping stones for the true **Flintlock** developed in France in



Flintlock Mechanism

the early 1600's. It had features of all the others and was a safe, simple arm. The action of the hammer holding a flint in its jaws struck the steel and opened the pan cover at the same time so that a spark might fall in the flash pan. To this was also added a stronger sear that allowed for a full cock or a safety half cock. This new system met with some opposition at first but by 1700 it was almost universally accepted.

THE COMING OF PERCUSSION DETONATION

In 1807, Alexander Forsyth patented a new detonating compound composed of either fulminate of mercury or potassium chlorate. This would explode when struck by the hammer. This soon revolutionized ignition. There were no more free sparks and weather had very little effect. Mr. Forsyth brought out the first of these new systems known as the **pill lock.** To use this new device, a tiny pellet of the new compound was placed in the pan and when struck by the hammer produced enough fire to set off the main powder charge in the gun barrel.

The **tube lock** of 1816, developed in England, was just what the name indicates—a tiny tube filled with fulminate. This little tube when crushed by the hammer would ignite the main charge.

The **percussion cap** required the removal of the flash pan and the flash hole was again moved to the top of the barrel and fitted with a small iron tube called a nipple. The caps were known as Hi-hat musket caps, being shaped about like the old top hat of that day. These tiny cups were first made of iron and were not too successful. Next a pewter cap was tried with even worse results. Finally, in 1817, after a year of experimentation, a musket cap made from copper was found to be most successful. **Copper caps** were easy to form and were completed by putting a small drop of fulminate in the cavity covering it with tin foil and sealing with a drop of shellac. The caps used today are still made very nearly like this.

The sportsmen were quick to see the advantages of the percussion cap. Military men, however, were slower to be convinced and about 25 years were spent before it was accepted by the Army to replace the Flintlock.

RIFLING THE BARREL

Rifling of the barrel to give spin to the ball and thus stabilize it has been known for many years. Who the original inventor was is apparently not known. The first definitely placed arm of this type, however, was used in Germany in the late 1400's. These had straight grooves and it has been said that this was to provide a place to catch the fouling. Others have said it was to create a better gas seal with easier loading. This seems to be a more practical explanation. The soft lead ball would be easily cut by the rifling so the ball would touch the barrel, if patched or nearly so if not. Shortly after this, the rifling was given a twist to stabilize the ball. This important innovation, of course, has carried through the time until the present day.

In the early 1700's Swiss and German immigrants settling in Pennsylvania had brought with them the short rifle then in use. Here these old guns were gradually modified to meet new requirements. The barrel was lengthened for better sighting and to conserve lead which was in short supply. The bore was lessened. Fine craftsmen that these people were, by 1750 they had developed a completely new weapon that was to become known as the **Kentucky rifle.** This beautiful gun with its tiger tail maple stock would triple the effective range of any previous model. It has been stated that they were capable

of hitting a man size target at as much as 400 yards. Kentucky rifles were very popular for the next 50 or 60 years and even now they are much sought after by the serious muzzle loader fan.

RAPID DEVELOPMENT IN CARTRIDGES

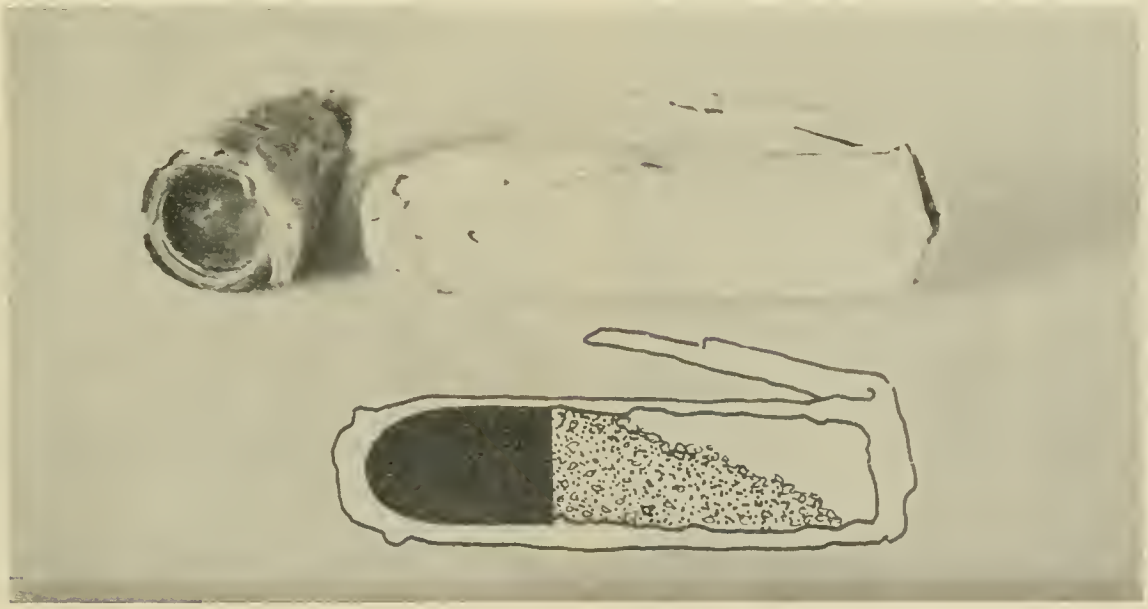
From the Revolutionary War, men had learned the need of an arm that would load like a musket and shoot like a rifle. Gunsmiths everywhere were working toward this end. Captain Minie of France found that an elongated bullet with an iron wedge placed in its hollow base would expand on firing and make a tight seal. This famous bullet was given his name — **Minie Ball.** Later at Harper's Ferry Armory, James Burton discovered that if properly formed, the bullet would seal without the use of an iron wedge. At this point, military men began to look on the rifle with favor. It could now be loaded as quickly as the musket and still have the advantage of the rifle.

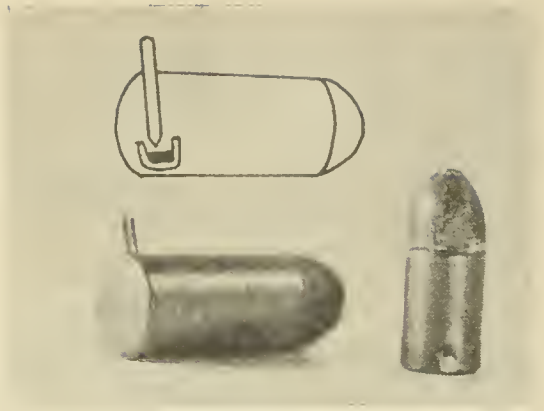
The **Minie Ball** was soon made in cartridge form — being rolled in paper and tied on the bullet end. A measured charge was poured into this tube and a special fold sealed the cartridge. These paper cartridges were carried in a tin box. To load, the seal or tail was torn off with the teeth, the powder poured down the barrel and the bullet rammed on top. All that remained was to place the cap on the nipple and the gun was ready to fire. With this method, a trained man could fire at the rate of three or four times a minute. In 1855, it was adopted by the United States armed forces.

The United States was soon to be engaged in a Civil War. The **Minie Ball,** developed though it was, left a great deal to be desired. The gun had to be somewhat upright to get powder and ball down the barrel with a ramrod. This made it difficult for a man to take advantage of any available cover. It became apparent that an arm that could be loaded from the breech and fired more than once without reloading would be very desirable. Inventors and gunsmiths were again having a heyday.

Early in the 1800's, the French had developed the **pin fire.** This little cartridge was perhaps the first to be completely self-contained. It was made with a drawn copper tube closed on one end to contain the powder and bullet. A pin was mounted sideways with a small speck of fulminate under its point. The pin was long enough to protrude above the gun barrel to be struck by the hammer driving it downward on the fulminate to detonate the

Minie Ball in Cartridge Form





Pinfire Cartridge

powder charge. There were some guns made for this little cartridge but good as it would have seemed to be, it never became really popular.

Many types of cartridges were being designed mostly on the principle of the Minie — their skins being made from paper, linen, skin and even rubber. They all had to rely on percussion ignition through a cut or tear in the base of the cartridge.

Many types of breech loading arms were made for these cartridges. None of these were too successful. All had the same common fault. The breech mechanisms leaked gas and sometimes flame was forced out, close to the shooter's face.

In 1852, Christian Sharps developed a suitable arm for the old paper cartridge. This first **Sharps** used a small copper disc, which contained a drop of fulminate. This was thrown forward by the hammer instead of the percussion cap. These were later given up in favor of percussion priming. The breech block was sharp on top and very closely machined into a channel vertical with the barrel. It utilized a lever action and when the lever was lowered, the paper cartridge was placed in the barrel. As the breech was closed, the sharp edge of the block cut off the end of the cartridge exposing the powder and the arm was ready to fire. These first **Sharps** were very strong and were considered a fine arm.

The **Volcanic cartridge** was self contained. The ball with its hollow base held the powder and a tiny pellet of fulminate that would explode when struck by the firing pin.

The **Needle gun cartridge** was also self contained. It was very similar in appearance to the paper wrapped Minie Ball with a small cup of fulminate on the back of the bullet. To fire, the needle-like firing pin had to first pierce the powder charge.

The **short Maynard** was a very interesting little cartridge—the head having a very small hole in the center for ignition by the tape primer. This tape primer looked very much like caps for a toy cap pistol and were placed in position on the nipple by the ratchet action of the hammer. This system was also given up in favor of the percussion cup. The rim of the cartridge was about 3/16 of an inch larger than the body and protruded slightly past the barrel so that it could be extracted with the fingers.

The **long Maynard** was completely self contained. The rim was large and was also extracted manually. It was especially interesting because the head was machined with an inset nipple in its center. A small musket cap could thus be placed over the nipple within the inset to be flush on its base. The base was machined, was about ⅝ of an inch in length and to this a brass tube was sweated to make a 40 caliber cartridge about 3½ inches over-all. This cartridge gave a good account of itself because it could be easily reloaded. However, because of the time involved in machine work, it was too costly and hence quite short lived.

RIM FIRE CARTRIDGES

Early experiments with the **rim fire** had not been too successful. The fulminate in the rim was also the propellant and the cartridge was very weak. In 1858, Smith and Wesson had purchased the famous Rollin White patent of a cylinder bored through from end to end to provide a breech loader. With this they developed the first **rim fire** as we know it today. The **rim fire** was easy to manufacture and was soon being made in many calibers and adapted to rifles. New rifles were soon developed and percussion guns were con-

The Spencer Family

verted. One of the most popular was the **Spencer rifle cartridge.** At least eight different rifles were chambered for these cartridges during the Civil War. These included such famous names as **Sharps** and **Ballards.** These were soon followed by stubby little cartridges like the **41 Derringer** and **32 Flobert**. The **44 Henry** lever action repeating rifle and cartridge was perhaps the most famous of them all.

To circumvent the Smith and Wesson held Rollin White patent, several odd cartridge known as **front loading** were developed. These included the **Thuer** by **Colt,** the **Woods cup fire** and the **national teat fire.** The Thuer was a center fire with a slightly tapered case to look somewhat like a rimless cartridge. The Woods had a cupped base in which the fulminate was placed around the rim. The mouth of the case was slightly flanged and the

41 Derringer — 32 Flobert

Long Maynard

Short Maynard

bullet set flush with the case mouth and sealed with tallow. The national was a similar case with the base formed into a small teat to hold the fulminate. In effect, these worked like a rim fire when the edge of the cup or the teat was crushed by the hammer.

CENTER FIRE CARTRIDGES

The rimfire, though very reliable, had its shortcomings. It was not possible to make a case strong enough to withstand the pressures of a heavy powder charge and still soft enough for the hammer to crush the rim for firing.

The early **center fire cartridge** was made with a number of different inside anvils. Probably the most common of these were the cup anvil and bar anvil. These were also made with a copper case that looked like a rimfire. By 1866, the United States had developed a **center fire cartridge** with a drawn brass case that with small refinements is still standard.

By 1890 both guns and ammunition had reached their peak. Guns had become long and heavy in order to handle the pressures and recoil of the ever increasing cartridge size. Some measured nearly 4 inches in length and were 40 to 50 caliber. **Note** picture on page 25 of some of these old Sharps and Winchester cartridges with today's 375 Holland and Holland fifth from right.

At this time, Winchester and Union Metallic Cartridge Company were experimenting with **smokeless powder** and a complete new line of cartridges was to come.

With smokeless powder, pressures were greatly increased and as usual the solution to one problem led to another. The increased pressure caused the lead bullets to deform or even strip in the rifling, leading to inaccuracy. As a solution to this problem, in 1894, Winchester developed their first smokeless cartridge with a metal patched bullet. This new cartridge was the **30-40** or **30 U.S.** and was the first to travel over 2,000 feet per second.

From this point on, we have watched propellant and projectiles develop through two world wars to a point where a rocket can travel around the world or hit the moon in a few hours. Looking back a hundred years, I think, makes us all a little apprehensive of what is to come in the next hundred.

For some reason, historians have not given much recognition to the 44 Henry cartridge, even though many arms were chambered for it and it gave an excellent accounting of itself. Head stamp "C D L" is for C.D. Leat. The "H" head stamp on Winchester cartridges is in honor of Henry, and the "U" is the stamp of Union Metallic Cartridge Co.

Cup Fire and Teat Fire Cartridges

Old timers were not exactly undergunned as demonstrated by the size of some of the old cartridges. Fifth from the right is a modern 375 Holland & Holland.

Above — 45 Colt (left) and Smith & Wesson early center fire cartridges.

Below — 50 X 70 Sharps

Although these have the appearance of a rimfire, they are true center fire, as can be seen by the misfire.

The survey crew goes to work on a lake of the Four Mile Basin area south of Georgetown Lake.

By BOB MITCHELL, Fisheries Fieldman and ART WHITNEY, Fisheries Manager—District 2

SERIES V—HIGH LAKE SURVEY IN HIGH GEAR

The four Trail Trout Series that have preceded this in Montana Wildlife have each described a fisheries survey of mountain lakes in one small portion of Montana's high country. Lakes were reached by foot or horseback, and the number surveyed was as many as careful planning, long hours and hard work could make possible.

The drainages selected to be surveyed were those containing problem lakes. Usually these were lakes where fishing was reported to have become poorer in recent years. Once a crew reached an area by packing in, however, it was most economical to survey all the lakes possible in that drainage. While this gave good coverage for our long-range inventory of waters, it also meant that widely separated problem lakes had to be surveyed in different years. For example, over 200 mountain lakes in District 2 are scattered throughout four widely-separated parts of the district, and survey emphasis could be placed on only one part of the area each year. This meant that some problem lakes might have to wait up to four years for survey. If two lakes happened to be at opposite ends of the same group, one of them might be carried on the survey list for eight years. Slow, usually difficult transportation, a short field season, and the widely-separated groups of lakes which demanded attention, seemed to destine survey of problem mountain lakes to a perpetual snail's pace. Then, early in

1962, the Fish and Game Department purchased a helicopter and we immediately began to modify our survey gear and methods to this form of transportation.

The 60-mile-per-hour speed of this flying pack horse allowed us to include lakes from many drainages on our 1962 program, and on July 17th our high-gear, high-lake survey got underway on Mountain Ben Lake in the Flint Creek range, north of Anaconda. The survey covered 45 lakes in four major drainages and ended on High Park Lake in the Mission Mountains on September 7th. Forty-four hours and 40 minutes of actual flying time for the summer made our transportation cost $3,350. This is $74.44 per lake—$5.00 less than the lowest cost per lake for rented, horse-back transportation.

Twenty-one of the 45 lakes surveyed in 1962 were in the upper Clark Fork drainage of the western district. They were in five separate portions of the drainage and extremes of the group were 35 miles apart. Survey by our old method would have taken approximately 30 days —with the helicopter the job was finished in 13. Following is a discussion of these 21 lakes and a few others in the same area which had been surveyed earlier. The lakes in the other three drainages (Big Hole, Kootenai and Swan) will be left for other Trail Trout Series.

Mountain Ben Lake is at the head of the **Dempsey Creek Drainage,** west of Deer Lodge. It has a good population of cutthroat and rainbow trout, up to 11 inches long. Because spawning areas were available and the fish were in poor condition, indicating too many for available food, this lake was removed from the planting program. **Carruthers Lake**, below **Mountain Ben**, contained good numbers of cutthroat trout; however, the largest fish were only 9 inches long. This lake is quite similar to the two Elliott lakes in the same drainage which were surveyed in 1959. All had shoreline spawning facilities and large numbers of small cutthroat trout. The Elliott Lakes, Carruthers Lake and Mountain Ben Lake are all quite sterile, and each has an irrigation dam on its outlet. Even though they are not good fish producers, they could all stand more fishing pressure than they receive at present without requiring artificial stocking. Three remaining lakes in the Upper Dempsey Creek drainage—**Goat Lake and two unnamed lakes**—were considered too small to be worthy of management efforts at the present time. This is particularly true in an area where four larger lakes are now under-fished.

An extremely rough boulder-strewn jeep trail up Dempsey Creek ends about one-half mile from Lower Elliott Lake. One foot path from the end of the jeep trail leads to the two Elliott lakes and another takes you to Carruthers and Mountain Ben. Use as small a four-wheel drive rig as you can on this trail as it is impossible for a long-wheel based unit to miss all the boulders.

Alpine Lake, in the **Racetrack Creek Drainage,** can be reached by four-wheel drive vehicles. This lake was stocked with rainbows several years ago and although fish were scarce, some up to 4½ pounds were taken. The irrigation dam on this lake's outlet causes an 18-foot annual drawdown which eliminates natural spawning. Thus Alpine is a lake where continued artificial stocking is necessary and it has been added to the planting program.

Southwest of Alpine Lake, and also in the Racetrack drainage, are the six **Meadow lakes.** These had been surveyed in 1958 and were reported in the first Trail Trout Series. In 1961, anglers reported that the fish in Lakes 1, 2, 4 and 5 were getting smaller, so the lakes were scheduled for resurvey. Lakes 1, 2 and 5 contained many skinny fish. For this reason these lakes will be removed from the planting program for at least four years. Lake Number 4, although it had been stocked as heavily as the other three, had a very low population of small fish. Apparently the lake is subject to partial winter-kill each year and therefore should not be stocked as long as three nearby lakes contain good fish populations.

Little Racetrack was the sixth and last

Sometimes high mountain lakes have too many trout, resulting in stunted fish.

lake surveyed in the Racetrack drainage. This lake lies between Fisher and Big Racetrack lakes, both of which were surveyed in 1958 and reported on in SeriesI of Trail Trout. Little Racetrack Lake has good numbers of cutthroat trout up to 10 inches and rainbow trout to 17 inches long. The fish are maintaining themselves by natural spawning and no stocking is necessary.

The five **Fourmile Basin Lakes** in the **Twin Lakes Creek Drainage** are reached by foot trail from the Twin Lakes Creek road. **Lakes 1 and 2** are too small and shallow to support good fisheries. Lake No. 1 contained a few small rainbow trout, however recent change in the rock structure of its basin has lowered the lake's level 12 feet and reduced its area by half.

Lake No. 3 has a heavy population of brook trout up to 10 inches long. Natural reproduction has resulted in over-population. The amount of fishing pressure at present is inadequate to take surplus fish. It is a lake where even the novice fly fisherman should have little trouble taking his limit, however the fish will be small.

Golden trout form the entire fish population of **Lake No. 4.** These fish were stocked as yearlings in the summer of 1960. They ranged in size from 7 to 11 inches long and were spawning in the shallow areas of the lake during our survey in 1962. This lake should be checked again in the future to determine the success of the golden trout reproduction.

Although old records indicate **Lake No. 5** had been stocked at one time, no fish were present in 1962. This 20-foot-deep marginal lake is probably subject to winterkill and should not be managed as a fishery at the present time.

Dora Thorn and **Sidney Lakes** are at the head of Copper Creek in the **Boulder Creek Drainage** east of Philipsburg. They can be reached by foot trail from the Fred

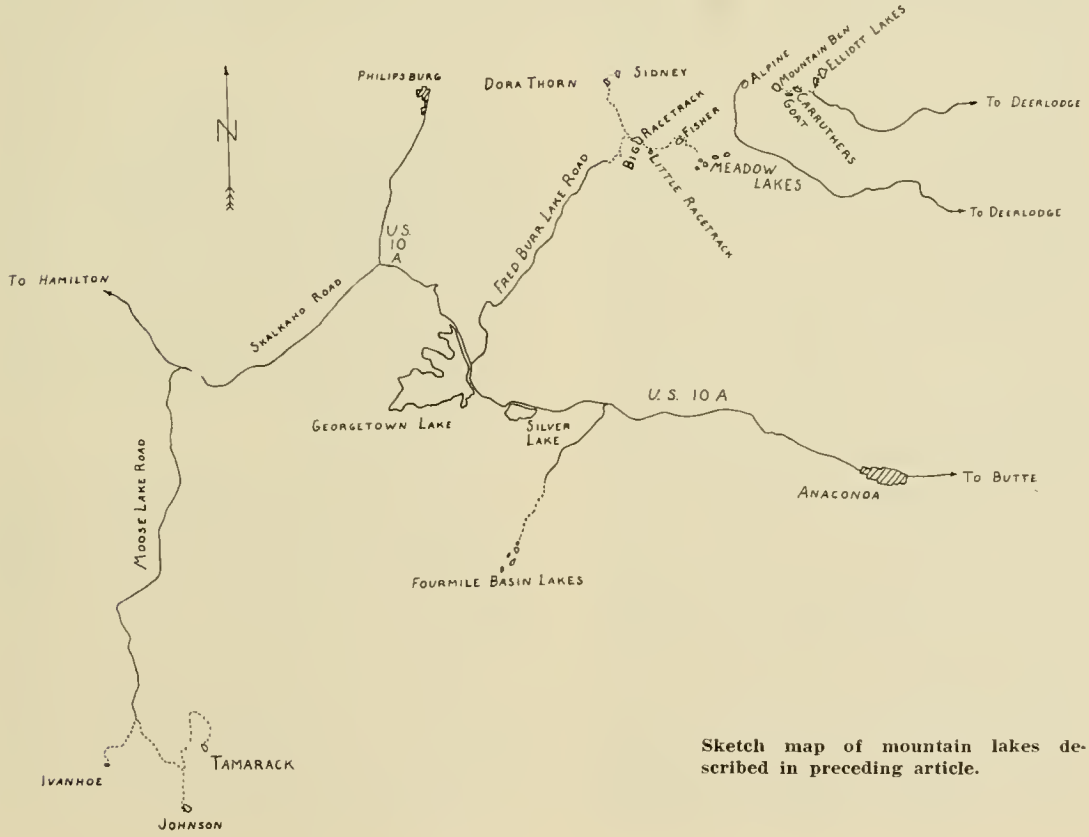
Burr Lake road off U.S. No. 10A at Georgetown Lake. Sidney Lake had good populations of both cutthroat and rainbow trout and each species ranged up to 12 inches long. Dora Thorn had a good cutthroat trout population with individuals up to 12 inches and a few rainbow trout up to 14 inches in length. Spawning redds were found in both the inlet and outlet of Sidney and in the outlet of Dora Thorn. Hybrids between the two species of trout were numerous in Sidney Lake. Stocking will not be necessary in the immediate future on either lake.

The District 2 portion of the 1962 high-lake survey was completed on three lakes in the Pintlar Primitive Area. These lakes were **Ivanhoe, Tamarack** and **Johnson** on the **Middle Fork Rock Creek Drainage.** The trail to these lakes takes off from the Middle Fork Rock Creek road above Moose Lake.

The Senate Mine fork of this trail leads to **Ivanhoe Lake** which has a small population of rainbow trout up to 12 inches long. Fair reproductive success has maintained the numbers of these fish and the lake needs no stocking at this time.

Tamarack Lake, on another branch of the Middle Fork Rock Creek trail, has no fish and is only 13 feet deep. This lake is marginal fish habitat and does not warrant stocking.

Johnson Lake is the first lake on the Johnson Lake trail into the Pintlar Primitive Area. This large (approximately 70-acre) lake has an excellent camping area, is in exceptionally scenic surroundings and probably receives more visits per year than any other lake in the primitive area. Johnson Lake has a fair population of cutthroat trout and numerous longnose suckers. When techniques for chemically treating high-mountain lakes to remove undesirable fish have been perfected, Johnson Lake should be one of the first primitive area lakes to be rehabilitated.



Sketch map of mountain lakes described in preceding article.

Big Fish *in Montana*

The old timer's eyes twinkle as he holds his hands wide apart with "Sonny you should have seen how big the trout used to grow here!"

Unfortunately, there are few records to verify the tales of lunker trout. Perhaps they did exist, or perhaps mediocre fish have grown monstrous, fed on years of imagination.

Except for passing mention and a possible picture in local papers, bragging-sized fish have mostly gone unrecorded in Montana. A few have been entered in the "Field and Stream" annual fishing contest, and this publication has graciously supplied the following list of the largest fish entered from Montana, 1911 through 1961.

LARGEST FISH ENTERED FROM MONTANA IN FIELD AND STREAM ANNUAL FISHING CONTEST, 1911 THROUGH 1961

Division	Weight	Angler	When Caught	Where Caught	Lure
Brook Trout, Fly-Casting	9 pounds 1 ounce	John R. Cook	May 25, 1940	Lower Two Medicine Lake, Montana	Home-tied salmon fly
Brook Trout, Open	8 pounds 4 ounces	Adolph F. Favero	July 10, 1951	Rock Island Lake, Montana	Colorado spinner
Brown Trout, Fly-Casting	12 pounds 4 ounces	B. E. Allen	July 19, 1931	Baker Creek, Montana	Cahill fly
Brown Trout, Open	20 pounds	David J. Fuller	June 27, 1958	Hebgen Lake, Montana	Luhr Jensen lure
Rainbow Trout, Fly-Casting	19 pounds 12 ounces	John T. Carson	October 6, 1935	Big Hole River, Montana	Squirrel-tail fly
*Rainbow Trout, Open	20 pounds	C. J. Brohaugh	May 29, 1952	Cliff Lake, Montana	Colorado spinner
Cutthroat Trout	16 pounds	William D. Sands	June 5, 1955	Red Eagle Lake, Montana	Thomas Goldfish

* The following entry was received in 1919 but, unfortunately, the announcement of winners that year did not list where fish were caught. However, the angler lived in Montana so possibly this is a tie for the largest rainbow trout.

Rainbow Trout, Open	20 pounds	Jack Derville Butte, Montana	1919	Ted Ross spinner

It would be of interest to sportsmen and an advantage to fisheries workers if a list were kept, over passing years, of larger Montana fish taken. The Fish and Game Department is prepared to compile and maintain such a listing, but we must depend on you fishermen to supply the data. No prize will be offered, but each spring "Montana Wildlife" and whatever newspaper coverage can be mustered, will carry a running list of larger fish taken the past season, where they were taken, and who took them. So we are requesting that if you take an unusually large fish, regardless of what kind it is, report it to the Fish and Game Department—I & E Division, Helena.

Standards must be set. Of course, the fish must be taken by legal means from Montana waters. They must be weighed on scales legal for trade to within the nearest ounce, and weight must be attested by signature of two witnesses. The length of the fish to the nearest ⅛ inch must be determined by laying it on a yard stick or other rigid rule. Measurement must be from the point of the snout to tip of tail when depressed. Measurements by flexible rules are not accurate because they may curve around the body and give a biased reading.

When sending information on fish, list where and when the fish was taken and by what lure, fly, or bait. A photograph of the fish and fisherman would also add interest and authenticity to an historical file.

If there is any doubt as to just what kind of fish you have, contact one of the fisheries personnel for positive identification.

Can you top any of the fish listed here?

DIVERSIFIED DUDES

By DON BECKMAN, Ft. Peck, Corps of Army Engineers

This past hunting season has evolved some radical changes in outfitters and hunters in Eastern Montana, in the Fort Peck Reservoir Area at least.

A rather wet year with a warm, late fall resulted in some change in big game habits too. Practically all of the alluvial filled coulee bottoms which discharge into the Fort Peck Lake were covered with a thick stand of wild sweet clover which grew and stayed green and lush up until the first week in December.

Game such as the Mule deer relish this "ice cream" serving, so as is natural, these animals concentrated in the areas of clover near the lake shore. Does and fawns stayed near this supermarket while the older and wiser bucks would feed at night, and as is their habit, would climb to the higher rims during the day to maintain their personal safety and comfort.

In former years, the deer spread out quite uniformly over the Fort Peck Game Range and surrounding lands, with the larger bucks circulating about the higher parts of the area.

As those know who are familiar with the Missouri breaks area, hunting involves access to the places where the game can be found. This is where the outfitter comes in.

This year, several outfitters realized the game was utilizing the green forage near the shorelines. A hunting expedition to take advantage of this situation required several new facets to hunting. To obtain access to the area, a boat was employed, not just a small boat with a "kicker," but a cabin cruiser or similar sized craft with a husky power plant capable of getting up and sizzling along at 20 to 30 miles per hour. From necessity, the craft has to be seaworthy and the operator has to be skilled.

The Fort Peck Reservoir has some 1,600 miles of shoreline (that's more than the coast of California), and there are open water stretches that will develop waves up to 14 feet in height. In these fresh water lakes the waves are also short across the trough, which means that a 16-foot boat will alternately stand on its ends in these open water fetches when wind velocity is high. So, in order to assure returning his customers in one large attractive piece, the outfitter has to have a boat capable of handling rough water and with speed enough to cover the great distances of shoreline or to get into a quiet bay when a storm comes up, and with size enough to stay there until the storm is over. The boat operator, although not required to have a Coast Guard Motorboat Operator's license when carrying less than six passengers for hire, frequently is licensed. This is not because the license makes a safe operator, but because of the proficiency that is needed to obtain the license.

After transporting the customer to the area to be hunted, there is usually a spike camp where the hunter stays a few days. Here he may utilize horses, a jeep, a four-wheel drive power wagon, or he may just hunt on foot in the very inaccessible areas. Once the kill is made, the process of transportation back to the spike camp is accomplished, usually by dragging, or by the use of horses.

The final word to the story is written when the game is loaded aboard the boat and brought out.

Access to some of these areas can only be had by watercraft. Even horses, and the more modern two-wheeled vehicles are useless in these places.

As the Fort Peck Game Range and its potentials for hunting become widely known, the seasoned, competent and honest outfitter will find an ever increasing demand for his services, and the recreational developments of the Fort Peck Area will have a new industry.

Antelope Change Mating Habits Under Spell of Islands

This Montana antelope looked somewhat out of plaee on the docks of Honolulu.

During late 1959, and amid considerable fanfare, 38 Montana antelope were hoisted over the side of the "Hawaaian Planter" and plunked down on the docks of their new homeland. Here in Hawaii, they were to share with pineapple growers the island of Lanai. It was hoped to start a new herd—the first of any consequence outside of the continental United States.

Wrote Joe Medeiros, wildlife biologist for Hawaii, "Unfortunately, the animals mistakenly took the Pacific Ocean to be a large Montana lake and immediately headed for it. The sportsmen came to the rescue and, after much herding, the main group returned to the selected release area the following day. Drowning, and blindness caused by the thorns of the Algaroba and Klu, plus accidents, took their toll so that a month later only 18 animals were known to have survived."

Having become at least partially acclimated to their new homes, the does fawned eight new members to the herd during June 1960. In 1961, the first antelope birth of the year was recorded on May 17 and by the end of the kidding season, 15 new-born were known to have survived. Things were looking up! Last count in July, of 1962 was 26 does, 31 fawns and 13 bucks on Lanai. Hawaii now feels that the "lopers" have definitely become established and are on their way to producing a good herd.

A sure sign that the animals have acclimated to the year-round balminess of the south seas was birth of a fawn in December, 1962. All antelope hunters know this just doesn't happen in December—not in Montana at least! Change from a seasonal breeder to ones that may mate any time of year are not new in Hawaii, however. It has occurred in other introduced animals — notably Axis deer. Just how nature contrives for animals living in severe climates to bear their young during the most advantageous time of year leaves something for us to ponder.

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